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ABSTRACT

This study investigated whether mothers' responses to their infants' gestures play a role in their infants' vocabulary development. Eight infants were observed interacting at home with their mothers on 2 occasions, when the infants were 10 to 12 months old, and 16 to 18 months old. Videotapes of the observations were transcribed and coded for maternal utterances, infants' gestures, infants' other actions, and infants' verbal production. Data pertaining to the relation between maternal references to objects and actions in response to 10- to 12-month-old infants, and 16- to 18-month-old infants' vocabulary were analyzed. Results indicated that the frequency with which mothers named the objects on which 10- to 12-month-old infants focused was correlated with 16- to 18-month-old infants' total number of words used. The ratio of instances of maternal naming of objects in response to 10- to 12-month-old infants' gestures and instances in response to infants' other actions was correlated with the number of types of words 16- to 18-month-old infants used and the percentage of nouns in the infants' vocabularies. A list of 17 references is provided. (Author/SM)

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The City University of New York, Graduate School
Developmental Psychology Program

Maternal object and action references in response to infant gestures
and other attention-indicating actions

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This report fulfills, in part, the second year research
requirement of the Developmental Psychology Program

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Abstract

Eight mother-infant dyads were observed in the home at 10-12 months and again at 16-18 months of infants' age during play and meals. Videotapes were transcribed and coded for maternal utterances, infants' gestures, and infants' other attention-indicating actions, and infant verbal production. Spearman rank-order correlations were carried out between object and action references in maternal utterances in response to 10-12 month-old infants' gestures and other attention-indicating actions, and infant vocabulary measures 6 months later at 16-18 months of age. Among the significant findings were that the ratio between maternal object references which labelled the infants' focus of attention in response to gestures with object references in response to other infant actions at 10-12 months was significantly correlated with the word types and the percentage of nouns in the infants' vocabularies at 16-18 months. The results supported the hypothesis that infant gestures serve to indicate to the observant adult where the infant's focus of attention lies, providing opportunities for the adult to label objects indicated by the infant, thus facilitating initial vocabulary acquisition.

Many studies have emphasized the continuity between prelinguistic communication patterns in infant-parent exchanges and later speech patterns. Although there appear to be similarities between the responses of mothers to infant gestures and their responses to children's communicative speech (Masur 1982), the influence of maternal response to child gesture has not been studied directly. Adult responses to infant gestures may contribute to early vocabulary through a process by which infant and adult achieve mutual focus on environmental phenomena of interest to the child, while the child is simultaneously engaged in communication with the adult and may be receptive to learning labels for these phenomena. Receptivity may be enhanced under these circumstances because the communication was self-initiated.

Infant gestures can be seen as serving the communicative functions represented by the adult meaning of each gesture: e.g., the point as deictic, the object extension as an offer. Once in place as intentional productions, however, gestures can alternatively be seen to serve as indications to the infant's observant adult communicative partner of where the infant's attention lies. Leung and Rheingold (1981), in a study of infants with their mothers in a laboratory situation, found evidence that infants' points serve as a form of communication: the infants vocalized and/or looked at their mothers during 94% of their points. The infants' points were good indicators of what their focus of attention was: the vast majority were directed towards the attractive experimental stimuli. Mothers readily

responded to their infants' points, looking at the object indicated or verbally acknowledging most of them. Although they did not provide statistics, Leung and Rheingold also reported that the mothers supplied the infants with the names and properties of the objects and with descriptions of their own and the infants' behavior in their verbalizations in response to their infants' points. Thus the adult can incorporate her awareness of the infant's immediate foci of attention into her verbalizations to the child.

In the optimal situation, repeated instances of similar adult responses to phenomena which have repeatedly been indicated as the focus of the infant's attention can provide the infant with opportunities to extract, from the multitude of verbal material presented, the verbal labels which correspond to the phenomena of the child's interest. Conversely, the parent's verbalizations may not reflect or provide information about the gesture-indicated phenomena. While these verbalizations may be reasonable utterances for conversation with a more advanced communicative partner than the infant, they may not provide effective material for the infant to acquire an initial vocabulary. So, by gesturing, the child actively provides the adult with opportunities to comment upon what the child already has in mind, which the adult may or may not take up.

The gesture-response process may affect the child's acquisition of single words (or very short phrases) in the second year of life. The intentional production of gestures probably arises out of the adult's interpretation of infant gesture-like movements as intentionally communicating, and serving the same functions as their adult equivalents (Lock, 1978). The infant then uses the knowledge acquired from the responses these movements provoke, whenever he or she intends to provoke a particular response. Once the gestural system has developed to a certain level of intentionality, the child can use that system to acquire a verbal vocabulary through

interactions with an adult conversational partner.

Bakeman and Adamson (1986) studied infants at home in three conditions: interacting with mothers, with peers, and alone, and found that the infants used conventionalized acts (gestures and words) most frequently when interacting with mothers, and at an earlier age with mothers than with peers. Thus, adult attention encouraged the infants to gesture and produce words. These findings fit in with the notion of infant gesturing as part of the interactional system between infant and adult; the adult's attention encourages the infant to gesture, while the gesturing of the infant encourages the adult to respond.

Bates, Benigni, Bretherton, Camaioni, & Volterra (1979) see the emergence of both gesture and language as based on a common cognitive underpinning. In their view, correlations between gesture and language measures reflect the emergence of the symbol. In a study of 9- to 13- month old infants, they found that gestures (particularly pointing) do predict language measures. They place emphasis on changes in the individual which explain communicative development; they do not address how gestures may function in the parent-infant relationship to support the acquisition of language. The viewpoint investigated here is that the gesture serves to indicate to the adult where the infant's attention lies, and when joint reference is thus achieved, to elicit the name and further interaction with that object from the adult.

In Bates, Bretherton, Beeghly-Smith, & McNew's (1982) review of the social bases of language development, they point out that while it is plausible that "motherese" aids language acquisition, its existence has been better documented than its effects; and they warn that the interpretation of the results of correlational studies often presents great difficulties, for a number of reasons. Their generally negative stance may be rooted in their own theoretical emphasis on the individual's

contribution, rather than social interaction, to language development. They do not report on research on preverbal interaction which was not correlational, as their reasonable contention is that plausibility is an insufficient basis for conclusions. However, the correlational studies they do cite as evidence of little support for preverbal social interactional influences were not designed to study the specific effects of particular maternal behaviors (e.g., naming objects in conjunction with nonverbal cues) at particular developmental stages (e.g., directly before first words are produced). As they point out, little of this research has been carried out.

Masur (1982) recognized the similarities between the study of maternal responses to infant gestures and studies which showed that certain maternal responses to children's verbalizations were correlated with children's language acquisition: in both, the relevant phenomenon was that the mother commented on what the child had just communicated about. In her review of research on child-directed speech, Snow (1986) reported that a number of studies have found that expansions, "full, correct expressions of the meaning encapsulated in children's telegraphic utterances" (p.81) have a positive effect on the children's acquisition of syntax. She also reported that several studies have found that the percentage of maternal utterances which were semantically related to the child utterances they followed best predicted the child's linguistic ability. For example, Barnes, Gutfreund, Satterly, and Wells (1983), studying children with an initial mean length of utterance (MLU) of 1.5 (ranging in age from 1;6 to 2;9, with a mean age of 2;0), found that the frequency of maternal utterances at the initial recording session which were semantic extensions of the children's previous utterances was positively correlated with increases in the children's MLU nine months later.

What sort of adult responses would most effectively provide raw material for the child's learning of single-unit utterances, which the child can then use as

part of a productive vocabulary to communicate about the world? Probably those responses which include words for aspects of the environment (including the child's own activity) which the child can readily sense: for example, names of objects and common actions would be most effective. The establishment of mutual focus would be necessary for the adult's responses to be linked by the infant to their referents.

Several researchers have examined how mothers and infants establish mutual focus, and have proposed that particular behaviors are potentially important nonverbal cues which support the early acquisition of vocabulary: labelling during picture-book reading (Ninio and Bruner, 1976), maternal pointing (Murphy and Messer, 1977), visual co-orientation (Collis, 1977), and infant manipulation of objects (Messer, 1978). Murphy (1978), studying infants of 9, 14, 20, and 24 months, reported that mothers differentially named objects pointed at by both themselves and their infants, depending on the age of the child, naming more (in comparison with other verbal categories) with 14-month-olds than with older infants, especially when the mothers were pointing. She accounted for the age-associated differences with her observation that by 20 months, many of the infants were providing their own verbal labels. Thus the mothers were using nonverbal gestures, both the infants' and their own, to establish joint reference and name objects. However, none of these researchers provided the longitudinal data regarding the infants' language development which would assist in examining whether these cues are actually used by the infant to learn words.

Macnamara (1977), in an experiment in which he provided 12- and 17-month-old infants with simultaneous but conflicting object-related nonverbal cues (experimenter gesture and eye gaze) and utterances, found that the infants responded preferentially to the nonverbal cues rather than the utterances. For

example, holding object X in his right hand and object Y in his left hand, he would say, "Show me X" while extending Y towards the infant; the infant would then indicate object Y. It is plausible then that infants could use these cues to learn the names of objects. However, whether adults link their own gesturing and object labelling reliably, frequently, and saliently enough in the home situation to make it plausible that infants use these links for the purpose of acquiring a vocabulary has also not been explored.

A distinction important to the acquisition of vocabulary may exist between those indicators of the child's attention which are gestural, and generated by the child, and those which are not. The active infant of a year old almost continually provides non-social indications of attention, through the direction of visual gaze or by touch, in the exploration of the environment. However, this focus changes rapidly, perhaps too rapidly and too often, for the adult to effectively provide verbal labels in such a way that the infant can know to which aspect of the environment the adult refers. Maternal gesturing may establish joint reference without invoking the infant's readiness for word acquisition. With the gesture, however, the child is actively engaging in communicative behavior, and the child's attention is more or less simultaneously on the adult and some aspect of the environment (Masur, 1983).

Masur (1982), in a study of mothers' object-labelling responses to infants' (aged 0;9 to 1;6) object-related gestures, proposed that mothers' naming of objects that are already the focus of their infants' attention would assist their word acquisition. She found that mothers labelled the indicated objects more often in response to points than to reaching or extending objects, which she interpreted as demonstration that mothers interpreted pointing as a deictic referential signal. In turn, the infants produced more object-labelling words with their points than with the other two gestures. As well, the proportion of object-labelling responses by the

mother in response to points was correlated with the number of different object names in their infants' lexicons. Masur's study did not, however, address how mothers' responses to gestures compared with their object-labelling during their infants' other activities, or during the mothers' activities.

Perhaps the child's productive use of communicative action, nonverbal though it may be, indicates the activation of the communicative system which includes language, and a receptivity for acquisition. Inclusion of an object in the gesture indicates what aspect of the environment the child is ready to receive information about. It should be noted that verbal labels are not the only information which the child acquires; the adult can, for example, also provide useful information regarding the use and desirability of the object. This can assist retention of the word by rendering the object even more interesting and meaningful to the child.

In the present study, two observations each were made of 8 infants with their mothers; the first at 10-12 months and the second six months later, at 16-18 months of age. It was predicted that the rate at which mothers responded to their infants' gestures with verbalizations that included references to the objects or actions indicated by infant gestures at the first age would be correlated with the rate of language production, as indicated by vocabulary size and production rate at the second age. This would support the hypothesis that the type of mothers' responses to infants' gestures are important in providing the material upon which infants work in acquiring their first vocabularies, and would give an indication as to the type of response which promotes that acquisition.

Method

Subjects

Participants in the study were eight infants and their mothers, all of whom resided in New York City. The mothers were recruited through word of mouth: they were asked to participate in a study of infant communication, for which their infants would be videotaped at their homes in the mother's presence. The mothers were told that the study involved "how infants made their wants and needs known before they can talk". They were not informed that their own behavior would also be examined, until after the end of the first session. They were offered and provided copies of both videotaped sessions.

Procedure

The mothers and their infants were videotaped in their homes in the daytime for two one-hour sessions. At the first session, the infants were 10-12 months old. The second session took place 6 months later, when the infants were 16-18 months old. Fathers were also present at two of the second sessions. Three of the infants had preschool-aged siblings; none of the siblings were present at any of the sessions. The parents were told that this was a naturalistic study and that they should go on with their everyday routines during the videotaping. Mealtimes were chosen for study as well as play so that observations could be made during a regularly occurring caregiving activity which had the potential to involve the mother and infant in close interaction. When they were first asked to participate, by

telephone, the mothers were requested to schedule the videotaping for a time of day when their child usually had a meal or snack, and to proceed with that routine during the videotaping. Seven of the eight participants complied with this request in the first session, and all eight complied in the second session. In one case however, technical difficulties prevented the meal from being recorded; this dyad's second session was thus in the play context alone. The videocamera was hand-held, affording a degree of flexibility to the taping conditions. Mother and infant were able to move around the room or even go in adjacent rooms and still be recorded. An attempt was made to have the taping be as unobtrusive as possible: the experimenter stayed as far away as possible from the dyad, remaining quiet and still as possible while moving enough to keep the dyad in view. Whenever possible the experimenter sat on the floor or a chair with the videocamera in her lap, looking down into the viewfinder rather than looking directly at the subjects.

Transcription and Coding

All videotapes were equipped with a running timer at the margin of the screen. All times transcribed were precise to the second.

First sessions (10-12 month old infants). The length of the videotapes used for coding was 30 minutes 11 seconds, of which 7'46" was of the meal and 22'25" was of other activity, mostly play. This corresponded to the usable lengths of the shortest videotape. For the other dyads, the first 7'46" of mealtime and 22'25" of play was included for use in the coding and analysis. The one exception was the one dyad whose first session did not include a meal; the first 30'11" of their tape

was used instead.

The first session videotapes were viewed three times. At the first viewing, the mothers' utterances and the times of utterance onset were transcribed. At the second viewing, the infants' object-related gestures, the object to which the gesture was oriented, and the times of gesture onset were transcribed.

The following gestures were recorded:

1.point: The infant extends arm out, elbow roughly straight, with fingers closed in a fist; except for the index finger which is extended continuing the line of the arm.

2.reach: The infant extends arm, elbow roughly straight, with hand open and empty.

3.extend (an object): The infant, holding object in hand, extends arm straight towards other person.

4.wave: (at a person): The infant orients arm in direction of person and moves hand or fingers up and down, palm down.

5.shake head: The infant quickly twists head to right and/or left.

6.clap: The infant repeatedly brings hands together, palms facing each other.

After the second viewing, the mothers' utterances and the infants' gestures were matched by pairing together each gesture with the maternal utterance which began within five seconds following the onset of the gesture. This matching resulted in three types of pairs: gestures followed by an utterance (response to gesture), gestures followed by no utterance (no response to gesture), and utterances

not preceded by a gesture (response to action). At the third videotape viewing, infant actions preceding those maternal utterances not preceded by a gesture were transcribed. These were actions which, like the gestures, preceded the utterances within five seconds. Since a number of actions can and did occur within five seconds, the actions chosen for transcription reflected an indication of where the infant's attention was focused: gaze, manipulation of objects, or large motor actions (such as crawling or walking towards some goal). The identity of the object focussed upon was also transcribed. When a number of actions occurred, or a number of objects were indicated as the focus of attention, those mentioned in the mother's utterance were chosen for transcription. If it was not evident from watching the videotape as to what object the infant was focussed on (if, for example, the object was out of view of the camera or not easily identified), the mother's utterance was used, if possible, to determine its identity, giving the mother the benefit of the doubt for correctly assessing and naming the object in question.

When the transcription was complete, the mothers' utterances were coded for (a) response categories, (b) references to objects, and (c) references to actions. When an utterance contained more than one noun phrase, it was divided up into its component phrases and these were coded as separate instances of responses, although to the same infant gesture or action.

The following are the coding categories and their descriptions:

(a) Response Categories: For each utterance, the category of the maternal response as indicated by the infant's activity in the immediately preceding five

seconds, or the absence of response to an infant's gesture within five seconds was coded.

1. The mother's utterance followed an infant gesture.
2. The mother's utterance followed an infant action.
3. There was no maternal response following an infant's gesture.

(b) Object References: Each utterance was coded for its object reference in relation to the object which was the focus of the infant's attention, as indicated by his gesture or action, in the five seconds previous to the utterance.

1. The mother named the object which was the focus of the infant's attention.
2. The mother named an object which was not present, or was not the focus of the infant's attention.
3. The mother used an abstract noun as the referent of an utterance, used a noun outside of the infant's experience (e.g., "Egyptians"), or used a descriptive term instead of an object label (e.g., used "strawberry-banana" to refer to yogurt).
4. The mother used a pronoun to refer to an object
5. There was no object topic in the utterance.

(c) Action References: Each utterance was coded for its action reference in relation to the action of the object which was the focus of the infant's attention, as indicated by his gesture or action, or the infant's own action, in the five seconds preceding the utterance.

1. The mother labelled the infant's current action, or the action of the object which was the focus of the infant's attention; this included temporary states of

objects (e.g., as in "Eric has the ball.").

2. The mother described a non-current action or an action which was not the focus of the infant's attention.

3. The utterance contained no verb, or no relevant verb, or no reference to action.

Reliability: An assistant who had not viewed the videotapes was trained to code the first session transcriptions. He recoded 44, 74, and 87 maternal utterances from three dyads. Of the object references, 95%, 86%, and 98% respectively were in agreement with the author's coding, with an overall 93% agreement. Of the action references, 91%, 93%, and 92% respectively were in agreement with the author's coding, with an overall 92% agreement. When disagreements occurred, the coding judgments of the author were retained.

Second Sessions (16-18 month old infants): The length of videotape used in the second session was 41'0", which was the usable length of the shortest videotape. For the other dyads, the first 41'0" were used in the transcriptions. Upon viewing, the infants' utterances were transcribed. It was not required that an infant's word precisely match the adult pronunciation or use of the word for its acceptance for inclusion as a word in the infant's vocabulary. Contextual cues and self-consistency were also used to distinguish words from babbling. All infants were at the one-word stage.

After transcription, the following measures of verbal production were determined for each infant:

1. Total words uttered (tokens)

2. Vocabulary Words (types)

3. Percentage of nouns in vocabulary (noun types/total types)

Data Analysis

It was predicted that maternal responses to infants' gestures would play an important role in vocabulary development. It was thought that the measures of the consistency of maternal references to the objects at which the infant gestured and the present action of those objects at 10-12 months would predict vocabulary measures at 16-18 months. Not only should the correlations be reflected in the frequency of responses to gestures which referred to the relevant objects and actions, but also in the differentiation mothers made between their responses to gestures and actions. This differentiation could make it easier for the infant to learn both the appropriate labels for objects and actions, and the efficacy of gestures in eliciting relevant verbal input. In other words, it was predicted that the mothers who differentiated more between their responses to gestures and actions, with relatively higher rates of object and action labelling to gestures when compared with actions when their infants were 10-12 months of age, would be the mothers whose infants had larger vocabularies and spoke more at 16-18 months of age. Thus, the results reported include not only correlations between the frequencies of categories of responses to gestures and vocabulary measures, and categories of responses to action and vocabulary measures; but also the ratios of the frequencies between responses to gesture and action and the vocabulary measures.

Besides the predictive value of the absolute frequencies of maternal utterance categories, the predictive value of the relationships between some of the

categories was also computed. For example, it was thought that in addition to the importance of the absolute frequency of all responses to gestures which contained appropriate object labels, also potentially important would be the relative frequency of object labelling when compared to noun or pronoun use which did not label the object of infant focus.

In addition to the percentages of each mother's utterances which belonged in each of the coding categories above (B1-5 and C1-3 for both responses to gestures and responses to actions), the following ratios were computed to: (a) relate the gesture-response or action-response categories with each other (1-3 below), (b) relate gesture responses to action responses within the same category (4 below) or (c) both (5 below):

1. For the percentages of the mother's utterances which were responses to (gestures, actions), ratios between those in which the mother named the object which was the focus of the infant's attention, and those in which she named an object which was not his focus of attention (B1gestures/B2gestures; B1actions/B2actions).

2. For the percentages of the mother's utterances which were responses to (gestures, actions) ratios between those in which the mother named the object which was the focus of the infant's attention, and in which she used a pronoun to refer to an object (B1gestures/B4gestures; B1actions/B4actions).

3. For the percentages of the mother's utterances which were responses to (gestures, actions), ratios between those in which the mother labelled the action which was the focus of the infant's attention, and in which she labelled an action

which was not the focus of the infant's attention (C1gestures/C2gestures; C1actions/C2actions).

4. For the percentages of the mothers' utterances for each coding category B1-5 and C1-3, ratios between responses to gestures and responses to actions (B1gestures/B1actions; B2gestures/B2actions; B3gestures/B3actions; B4gestures/B4actions; B5gestures/B5actions; C1gestures/C1actions; C2gestures/C2actions; C3gestures/C3actions).

5. For measurements 1-3, ratios between responses to gestures and responses to actions: [(B1gestures/B2gestures)/(B1actions/B2actions); (B1gestures/B4gestures)/(B1actions/B4actions); (C1gestures/C2gestures)/(C1actions/C2actions)].

Results

Table 1 shows the object and action references in the mothers' utterances which were responses to their infants' gestures. Table 2 shows the object and action references in the mothers' utterances which were responses to their infants' actions. Table 3 shows the verbal production of the 8 infants at 16-18 months: vocabulary words (types), total words uttered (tokens) and % of nouns.

Insert Tables 1, 2 & 3 about here

The difference in the percentages of utterances containing references to the object focussed-upon by the infant (B1) in response to gestures and actions is of note. For the four dyads (E, F, G, and H) in which the infants at 16-18 months produced the most types, tokens and percentage of nouns (see Table 3), the mothers had a higher rate of naming focussed-upon objects in response to gestures than actions. The mothers in the four other dyads did not differentiate as much in their responses to gestures and actions in naming objects focussed upon by their infants.

Correlations: Spearman rank-order correlations were calculated to determine the relationships between the maternal responses to their infants at 10-12 months, and

their infants' verbal production at 16-18 months.

Maternal responses to infant gestures

Object References: As Table 4 shows, of the five percentages of object reference (names object of infant's focus, names object not in infants focus, abstract noun, pronoun, no object reference) which were responses to infants' gestures, the only percentage significantly correlated with the infants' verbal production at 16-18 months was naming the objects of the infants' focus. The percentage of total maternal responses to gestures which named the object of infant's focus was positively correlated with the total number of words (tokens) produced by the infant at 16-18 months ($r_s = .68$, $N=8$, $p<.031$).

The ratio of the frequency of naming the object of the infant's focus to the frequency of pronouns in response to gestures ($B1/B4$) was positively correlated with the word total at 16-18 months ($r_s = .64$, $N=8$, $p<.043$). The ratio of the frequency of naming the object of infant's focus to the frequency of naming the objects not in the infant's focus ($B1/B2$) was significantly correlated with the percentage of nouns in the infant's vocabulary at 16-18 months ($r_s = .69$, $N=8$, $p<.028$).

Action references: As also shown in Table 4, none of the three measures of action reference in response to infants' gestures (names action which is the focus of infant's attention, names action which is not the focus of the infant's attention, no action reference) were correlated with infants verbal production at 16-18 months. The ratio of the frequency of naming the action which was the focus of

the infant's attention to the frequency of naming an action which was not the focus of the infant's attention (C1/C2) was also not significantly correlated with infant verbal production at 16-18 months.

Insert Table 4 about here

Maternal responses to infants' actions

Object references: As Table 5 shows, the same five categories of maternal object reference tabulated in response to infant gestures at 10-12 months were tabulated in response to infant actions at 10-12 months, and examined as possible correlates of infant verbal output at 16-18 months. None of these were correlated with any of the measures of infant verbal output. Neither were the measures of ratios of objects-focused-upon to pronouns (B1/B4), nor the ratio of objects-focused-upon to objects-not-focused-upon (B1/B2).

Action references: Also in Table 5, the percentage of mothers' utterances containing references to actions-focused-upon in response to infant actions at 12 months (C1) was positively correlated with the percentage of nouns in the infants' vocabularies at 16-18 months ($r_s = .62$, $N=8$, $p<.050$).

Insert Table 5 about here

Measures comparing maternal responses to infant gestures and responses to infant actions

Object references: As Table 6 shows, the ratio obtained by dividing the frequency of naming objects-focused-upon in response to gestures and those in response to actions (B1gestures/B1actions) was positively correlated with both vocabulary ($r_s = .80$, $N=8$, $p<.008$), and the percentage of nouns ($r_s = .63$, $N=8$, $p<.045$). Similarly, the measurement obtained by dividing the ratio of the frequencies of naming objects-focused-upon and pronouns in response to gestures and the ratio of those in response to actions $[(B1gestures/B4gestures)/(B1actions/B4actions)]$ was also positively correlated with both vocabulary types ($r_s = .80$, $N=8$, $p<.008$) and the percentage of nouns ($r_s = .63$, $N=8$, $p<.045$).

Action references: As can be seen in Table 6, the only measurement of responses to infant action comparing responses to gesture and action which was correlated with infant verbal output at 16-18 months was the category of no reference to action (C3gestures/C3action). This category was positively correlated with both vocabulary ($r_s = .74$, $N=8$, $p<.017$), and the percentage of nouns ($r_s=.63$, $N=8$, $p<.045$).

Insert Table 6 about here

Discussion

Object References. The correlations reported here support the original hypothesis, that maternal responses to infants' gestures naming the objects indicated by the gestures at 10-12 months of age would predict infant verbal production at 16-18 months. The correlations which most strongly support this hypothesis are: the frequency of the mothers' naming the object of the infants' focus in response to infant gestures, which was positively correlated with tokens; and the ratio of naming the object of infant focus in response to gestures and actions, which was positively correlated with both vocabulary (types) and the percentage of nouns in the infant's vocabulary. These second correlations are particularly interesting in that they suggest that what is important to the infants' learning object names is the adults' differentiation of response to the infants' gestures and other focus-indicating actions, in the direction of more object naming with gestures and less with other infant actions. This differentiation could demonstrate to the infants that their own communicative efforts are effective in establishing certain types of interaction with adults: in this case, establishing joint focus on, and talk about, objects. The tendency to use object names rather than pronouns ($B1_{\text{gestures}}/B4_{\text{gestures}}$) and more in response to gestures than in response to actions [$(B1_{\text{gestures}}/B4_{\text{gestures}})/(B1_{\text{actions}}/B4_{\text{actions}})$] are also in keeping with the effectiveness of maternal object labelling in response to gestures.

The negative results (lack of correlations) also fit in well with the general

conclusions. Naming the object focused-upon in response to actions did not correlate with later infant verbal production, suggesting that it is not merely the frequency of object labelling in general which assists the infant in acquiring object names, but object labelling under special circumstances which are related to the infant's own attempts to communicate.

Action References. The absence of correlation between the maternal action references and infant vocabulary may reflect a perceptual concentration by the infant on objects rather than on the objects' or their own actions. Differentiating among the movements which make up perceptible actions may be more difficult than differentiating among objects, for the infant, since the variables which differentiate among movements (such as speed, direction, and gait) tend to be less stable than those which differentiate among objects (such as color, shape, mass, taste, function, voice quality, and volition). As has been pointed out (e.g., Furrow et al, 1979), verbs in general may be less concrete, and thus more difficult, than nouns. Action vocabulary may be easier to acquire once object vocabulary is better established: once the identities of a certain number of objects have been learned, then it may be easier for the infant to focus on the labels for what the objects are doing.

One maternal action reference measure which did correlate with infant verbal production was the ratio between responses to infant gestures and actions of failing to use any action reference in the utterance ($C3_{\text{gestures}}/C3_{\text{actions}}$). This finding, while not predicted, fits in well with the original hypothesis of the effectiveness of maternal object naming in response to gestures. If fewer actions were described by

mothers in response to gestures when compared with actions, then presumably it would be easier for the infant to determine which part of the maternal utterance was the object label. Thus not only were mothers of the more verbal infants naming more objects in response to gestures, they were also naming the action less. It suggests as well that these mothers were focused on the objects indicated by the infants by their gestures, and were treating the gestures as intentional referential communication which called for verbal identification. Again, for these dyads, the infants' gesturing was successful in initiating joint focus.

Another, less expected, finding was that maternal labelling of focused-upon actions in response to infant actions was positively correlated with the percentage of nouns in the infant's vocabulary. This outcome can be satisfactorily integrated with the other findings: the mothers whose infants later had a larger percentage of nouns in their vocabularies were the mothers who differentiated most between infant gestures and actions. Thus, they were labelling objects more in response to gestures, but they were still focused on and commenting upon their infants' activities when they were not gesturing. A picture emerges here of a mother producing a running commentary on the infant's activities, but treating her infant's gestures in particular as opportunities to identify objects by name.

Furrow et al. (1979), in their study of the effects of mothers' speech to their children at 1;6 on their children's speech at 2;3, strongly emphasized two important points: (1), that different aspects of adult speech may facilitate language acquisition at different stages of the child's development, and (2), that, at the stage they examined, simplicity was a common factor uniting the correlations they found.

The present study addressed the first issue in that it was predicted and confirmed that responses to the child's own communicative attempts, reflecting a sensitivity on the part of the mother to the child's abilities at that stage would play a facilitating role. Whether or not responses to gestures at other stages would make a difference to acquisition, or only prior to acquisition of an initial vocabulary remains to be explored. I suspect that it would not be as important, given that it seems that gestures are important for the establishment of mutual focus, useful for the acquisition of the initial vocabulary; but once that basic vocabulary has been established, additional language abilities may be acquired through adult responses to child utterances. The second issue Furrow et al. emphasized was corroborated in the present study in that simplicity was found to facilitate acquisition, via more nouns than pronouns, fewer verbs, and responsiveness to the 'here-and-now' focus of the infant's attention.

This small study is just a beginning in terms of the work that needs to be done in order to discover how infants use nonverbal cues to acquire their first vocabulary. It is an initial probe to find in a general way how infant gestures differ from other nonverbal cues in promoting language acquisition. Several possible directions for this type of research are suggested by the limited scope of this study. Two goals are both to study more specific variables and broaden the parameters examined. The specifics of how mothers differentiate between infant gestures was begun by Masur's (1982) study of mothers' different object-labelling responses to infant points, reaches, and object-extensions, in which she found that mothers reply more often to infants' object extensions than to pointing to or reaching for objects,

but that they label objects more often in response to reaching or extending.

An area of research not yet undertaken is the comparison of different types of nonverbal cues: child-directed utterances in conjunction with adult gesturing, visual co-orientation, infant object manipulation, book-reading, as well as infant gesturing, to see how these affect word acquisition. Longer-term longitudinal work would also be interesting, to see how long early differences in acquisition perpetuate. Related to this issue is the question of adult consistency: are parents who display an "optimal" style at one age able to adapt to the changing linguistic needs of their children? Murphy's (1978) study, in which mothers changed their rate of object-labelling depending on the age (and object-labelling ability) of their children, suggested that adults are sensitive to their children's changing abilities and are able to adapt accordingly. Once optimal styles at different ages are identified, it will be possible to follow adults through their children's early years to examine consistency and adaptability.

Cross-cultural work (for example, Ochs and Schieffelin, 1984) has suggested that the mode of parenting examined here, in which parents impute communicative intentionality to their children's actions and early vocalizations, is far from a universal one. This does not render the study of Western-style parenting less valid. The documentation of differences in how children in different cultures begin to talk suggests the possibility for "natural" experiments in which different modes of interaction allow the examination of more widely differing variables. Perhaps what will be seen to be universal in acquisition is the adaptability of both parent and child to the context for development in which they find themselves,

within which they can employ modifications to meet their own or others' needs.

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Table 1

Percentages of Object and Action References in Maternal Utterances in Response to Infants'Gestures

References	Dyad								Mean
	A	B	C	D	E	F	G	H	
Object									
B1 names focussed-upon object	15	0	8	15	58	20	32	13	20.1
B2 non- focussed-upon object	10	10	10	6	12	24	7	4	10.4
B3 abstract noun	12	14	5	6	4	4	7	13	8.1
B4 pronoun	30	29	24	29	8	28	20	46	26.8
B5 no object reference	28	52	56	47	30	22	39	38	35.3
Action									
C1 labels focussed-upon action	5	0	11	6	27	4	18	4	9.4
C2 non- focussed-upon action	39	33	22	12	12	31	9	25	22.9
C3 no action reference	52	67	65	80	65	65	68	67	58.6

Table 2

Percentages of Object and Action References in Maternal Utterances in Response to Infants'Actions

References	Dyad								Mean
	A	B	C	D	E	F	G	H	
Object									
B1 names focussed-upon object	13	3	8	11	44	16	20	7	15.3
B2 non- focussed-upon object	7	6	18	3	9	14	12	13	10.3
B3 abstract noun	7	10	13	9	7	7	8	11	9.0
B4 pronoun	24	18	29	27	23	20	30	32	21.6
B5 no object reference	25	65	58	60	29	39	40	42	44.8
Action									
C1 labels focussed-upon action	9	7	14	14	26	9	15	15	13.6
C2 non- focussed-upon action	20	21	25	16	20	21	19	24	20.8
C3 no action reference	59	74	75	72	66	68	62	59	66.9

Table 3

Infant Verbal Production at 16-18 months

Verbal Measure	Dyad								Mean
	A	B	C	D	E	F	G	H	
Vocabulary Words (types)	4	5	8	11	20	31	31	39	18.6
Total Words Uttered (tokens)	24	34	26	52	161	208	306	130	117.6
% of nouns (noun types/total types)	0	40	0	36	55	48	71	54	38.0

Table 4

Spearman Rank-Order Correlations between Mothers' Responses to Gestures
at 10-12 months and Infants' Verbal Production at 16-18 months

References	Verbal Measure		
	Vocabulary (types)	Word Totals (tokens)	% nouns
Object			
B1 names object	.41	.68*	.61
B2 non-focussed object	-.23	.07	-.05
B3 abstract noun	-.22	-.37	-.11
B4 pronoun	-.20	-.61	-.51
B5 no object reference	-.29	-.33	-.26
B1/B2	.55	.57	.69*
B1/B4	.32	.64*	.51
Action			
C1 labels action	.09	.26	.28
C2 non-focussed action	-.48	-.59	-.55
C3 no action reference	.37	.39	.37
C1/C2	.42	.50	.50

* $p < .05$ ** $p < .01$

Table 5

Spearman Rank-Order Correlations between Mothers' Responses to Actions
at 10-12 Months and Infants' Verbal Production at 16-18 Months

References	Verbal Measure		
	Vocabulary (types)	Word Total (tokens)	% nouns
Object			
B1 names object	.25	.57	.48
B2 non-focussed object	.46	.24	.11
B3 abstract noun	.02	-.32	-.25
B4 pronoun	.47	.12	.17
B5 no object reference	-.08	-.17	-.18
B1/B2	.04	.26	.28
B1/B4	.25	.57	.48
Action			
C1 labels action	.60	.50	.62*
C2 non-focussed action	.07	-.28	-.24
C3 no action reference	-.35	-.22	-.38
C1/C2	.36	.36	.42

* $p < .05$ ** $p < .01$

Table 6

Spearman Rank-Order Correlations between Ratios of Mothers' Responses
to Gestures and Mothers' Responses to Actions, and Infants' Verbal
Production at 16-18 months

Reference	Verbal Measure		
	Vocabulary (types)	Word Total (tokens)	% nouns
Object			
B1 gestures/B1 actions	.80**	.62	.63*
B2 gestures/B2 actions	-.34	-.02	-.25
B3 gestures/B3 actions	-.28	-.30	-.06
B4 gestures/B4 actions	-.20	-.43	-.35
B5 gestures/B5 actions	-.30	-.24	.04
(B1 ges/B2 ges)/(B1 act/B2 act)	.57	.29	.41
(B1 ges/B4 ges)/(B1 act/B4 act)	.80**	.62	.63*
Action			
C1 gestures/C1 actions	.10	.33	.30
C2 gestures/C2 actions	-.42	-.62	-.60
C3 gestures/C3 actions	.74*	.60	.63
(C1 ges/C2 ges)/(C1 act/C2 act)	.24	.48	.37

* $p < .05$ ** $p < .01$